Clean Watersheds Needs Survey 2008 Guide for Entering Nonpoint Source Pollution Control (Category VII) Needs

In Clean Watersheds Needs Survey (CWNS) 2004, forty-one states and the District of Columbia reported needs in Category VII, Nonpoint Source Pollution (NPS) Control. Over half (63%) of NPS needs were documented by five state (Florida, Pennsylvania, New Jersey, Minnesota, and New York). Although good progress has been made in documenting NPS needs, there is still significant underreporting.

To increase participation in 2008, a new web-based data entry system is being used. The system allows local users (e.g. municipalities, conservation districts, land trusts) and multiple state users (e.g. state NPS coordinators entering NPS needs) to submit CWNS data to their State CWNS coordinator electronically.

Based on some state's experiences from CWNS 2004, the following provides resources, methodologies, and best practices for collecting NPS needs and costs information for CWNS 2008.

Getting Started

- Identify programs and organizations that have responsibility and/or provide funding for the NPS source categories in CWNS. Develop a list of agencies and individuals who can help provide needed information. See Resource List in Attachment 1 for ideas.
- Develop an introductory memo to take to initial meeting or to email to key contacts.
- Follow-up with personal contact (phone calls and meetings) with key contacts.

Eligibility Requirements

In general, this category includes the needs and costs associated with the NPS pollution control in the following subcategories (see Attachment 2 for subcategory definitions):

- Agriculture (Cropland)
- Agriculture (Animals)
- Silviculture
- Ground Water Protection (Unknown Source)
- Marinas
- Resource Extraction
- Brownfields
- Storage Tanks
- Sanitary Landfills
- Hydromodification
- Estuary Management (in National Estuary Program study areas only)

To keep the data in the CWNS consistent and credible, as well as comparable across the country, each project's documentation is required to provide:

1. **A description of the water quality or public health problem or threat**. Needs do not need to be located in 303(d) listed watersheds. Projects to protect waters as well as remediate them are eligible.

2. **The location of the problem.** For NPS projects encompassing less than 200 acres, a single latitude-longitude point meets this requirement. Larger projects are required to indicate the project area using one of the following: one or more polygon(s), a single county, or single watershed (8-digit HUC). Polygon(s) can be

drawn using a tool with the data entry system or using GIS software. A county or watershed can be selected if the project encompasses the entire county or watershed.

3. **The solution to the problem**. One or more specific pollution control measures or Best Management Practice (BMP) to protect water from potential or existing pollution problems must be identified.

4. **The cost for each solution.** Document specific costs for each BMP or pollution control measure. General costs, without identifying specific solutions, will not be accepted.

5. **The basis of the cost.** The source of the cost data (e.g., engineer's estimates, costs from comparable practices, estimates from equipment suppliers, NRCS EQIP and Wetlands Reserve Program (WRP) Eligible Practice Cost Lists) for each solution must be identified.

6. **The total cost.** This is the total cost of all NPS BMPs documented for the water body or location.

7. **Current documentation.** For needs greater than $20 million (January 2008 dollar base), the documentation date has to be January 1, 2002 or more current. For all other needs, the documentation date has to be January 1, 1998 or more current.

See attachment 3 for a list of documents pre-approved for CWNS 2008. More than one document may be required to meet criteria 1-6 listed above.

Best Practices for Documenting NPS Pollution Control Needs and Costs

Note: Communities with a population of fewer than 10,000 people are considered small communities and can use a simplified methodology to collect and document `needs. For more information, see the CWNS 2008 Guide for Entering Small Community Needs available at http://www.epa.gov/cwns/cwns2008.htm

CWNS 2004 Example

Mississippi used information included in their Section 303(d) Impaired Water list and TMDL Plans. The Section 303(d) Impaired Waters list was used to document needs and their locations. When available, TMDL plans were used to identify the pollutants, determine necessary load reductions, and develop a list of recommended BMPs to address water quality and public health concerns.

Mississippi determined the appropriate BMPs for each waterbody/ location based on the pollutants and needed load reductions identified in TMDL plans. These recommended load reductions were applied to comparable water bodies.

The cost of BMPs per unit was taken be from the Natural Resources Conservation Service (NRCS) 2004 Mississippi Environmental Quality Incentives Program (EQIP) Eligible Practice Cost List, except for stream restoration and forest management. Unit costs are statewide averages. NRCS' Electronic Field Office Technical Guides (eFOTOG), which contain conservation practice costs in Section I, are available by state at http://www.nrcs.usda.gov/technical/efotg/.

See Attachment 4 for a detailed explanation of Mississippi's methodology.

Note: In addition to using TMDLs, watershed-based plans and other planning documents that have been developed for the waterbody and its watershed can provide information about the source of NPS pollution, BMPs to be implemented, and the associated costs.

Additional Methodologies

Document needs for waters not 303(d) listed. Needs are not required to be in 303(d) listed waters to be eligible for CWNS. Watershed-based plans, other planning documents, loan and grant applications, and National Estuary Program Comprehensive Conservation and Management Plans are examples of other types of needs documentation.

Estimate the cost based on previous comparable projects completed within the last two years. This estimate of cost must be based on the cost of three or more recently bid or completed projects that are similar in size, scope, and geographic area (e.g., county, watershed) and for which detailed cost data are available.

In some cases, it may be appropriate to use this methodology to determine costs for larger geographic areas (e.g. region, state). Extrapolating is permitted for estimating BMPs in reasonably analogous watersheds (e.g., similar land use, weather patterns, and/or hydrology) and in areas with a reasonably analogous pollution sources (e.g., grazing, abandoned mine drainage) requiring the same BMPs. Proportional extrapolations of costs (i.e., if the cost to implement a program in a 10,000 acres watershed is $1,000,000 then the cost in a 20,000 acres watershed must be $2,000,000) are only acceptable if they are for the implementation of a specific solution that is directly related to areas, for example acquisition of easements, conservation tillage, nutrient management on agriculture fields, or riparian buffers.

Note: This methodology **must be pre-approved by your EPA region and EPA headquarters** before entering the data into the system.

Entering CWNS Data

Data entry for the next CWNS is from February 5 through October 27, 2008. For the first time, an Internet-based data entry system is being used. State NPS coordinators, other state personnel, municipalities, and other facilities and organizations will be able to submit CWNS data to their state CWNS coordinator electronically.

If states would like to have EPA review methodologies for documenting needs and costs in CWNS 2008 contact EPA (cwns@epa.gov) as early as possible. The review period will be from February- May 2008.

For More Information

Visit http://www.epa.gov/cwns to learn more about the Clean Watersheds Needs Survey

- **Access data from previous surveys**
- **Find contact information for state and EPA regional CWNS coordinators at http://www.epa.gov/cwns/whereyoulive.htm**
- **Learn more about CWNS 2008 and how to apply for access to the data entry system at http://www.epa.gov/cwns/cwns2008.htm**

Sign-up to receive updates by e-mail by contacting cwns@epa.gov

Attachment 1:
List of Potential Resources of NPS Data and Documentation

State and EPA regional NPS coordinators should be able to provide 319 (NPS) Program grant applications, watershed plans, and workplans. Coordinators' contact information is available at http://www.epa.gov/owow/nps/contacts.html.

State and municipal agencies responsible for:

- Environment and Natural Resources (e.g., water pollution control, land reclamation, waste management, hazardous wastes, brownfields)
- Agriculture (e.g., soil and water conservation, farmland protection)
- Transportation
- Health
- Rural Development
- Parks and Recreation
- Mining

Municipal and regional planning agencies

National Estuary Programs (designated under Clean Water Act section 320)

Nonprofit organizations

- Land trusts
- Watershed organizations
- Farmland protection/ open space organizations
- Foundations funding watershed protection activities

NPS funding programs

- 319 (NPS) Program grant applications
    - Documentation from the 319 applications should be available for multiple years. Any submitted applications that have not been awarded funds as of January 1, 2008 are considered nonpoint source needs.
- State Revolving Fund (SRF) Loan Program
    - SRF loan applications for NPS projects that are entirely or partly unfunded as of January 1, 2008 are considered needs.
    - Costs documented in loan applications can be used as part of comparable cost estimates.
- Natural Resources Conservation Service's (NRCS) Environmental Quality Incentives Program (EQIP) program funding applications
- USDA's Conservation Reserve Program (CRP) and Conservation Reserve Enhancement Program (administered by the Farm Service Agency)

TMDL Implementation Plans

Watershed-based Plans

Army Corps of Engineers

NRCS Electronic Field OfficeTechnical Guides (eFOTOG) contain state specific technical information about the conservation of soil, water, air, and related plant and animal resources. (Available at http://www.nrcs.usda.gov/technical/efotg/)

Attachment 2:
Descriptions of Nonpoint Source Subcategories

A- Agriculture (Cropland) activities such as plowing, pesticide spraying, irrigation, fertilizing, planting and harvesting.

B- Agriculture (Animals) activities related to animal production such as unpermited confined animal facilities and grazing.

C- Silviculture activities, such as removal of streamside vegetation, road construction and use, timber harvesting, and mechanical preparation for the planting of trees.

E- Ground Water Protection (Unknown Source) including wellhead and recharge area protection activities that cannot be to a specific cause of ground water pollution, such as leaking storage tanks, soil contamination in a brownfield, or leachate from a sanitary landfill.

F- Marinas including poorly flushed waterways, boat maintenance activities, discharge of sewage from boats, and the physical alteration of shoreline, wetlands, and aquatic habitat during the construction and operation of marinas.

G- Resource Extraction including any activity associated with mining and quarrying activities.

H- Brownfields, including any activity associated with land that was developed for industrial purposes and then abandoned, which might have residual contramination.

I- Storage Tanks, including tanks designed to hold gasoline or other petroleum products or chemicals that are located either above or below ground level.

J- Sanitary Landfills, including all activities to address leaching, on-site treatment, gas collection and control, capping, and closure.

K- Hydromodification, including any alteration of the hydrologic characteristics of coastal and noncoastal waters, which in turn could cause degradation of water resources. Examples of such activities include channelization and channel modification, dams, and stream bank and shoreline erosion. Any work involving wetland or riparian area protection or restoration is included under this category.

M-Estuary Management, including costs associated with a habitat protection for aquatic species, fisheries, oyster bed, and shellfish restocking and restoration, fish ladders, rejuvenation of submerged aquatic vegetation, artificial reef establishment, control of invasive vegetative and aquatic species, and water control structures for flow regime and salinity. This category is only used for management activities in the study areas of the twenty-eight National Estuary Programs (NEPs) designated under section 320 of the Clean Water Act

Subcategory changes from 2004

L- Individual/Decentralized Sewage Treatment needs are now in a separate category, *Category XII: Decentralized Wastewater Treatment Needs*. Category XII includes the costs associated with the construction, repair, or replacement of decentralized Cluster Wastewater Treatment Systems and Onsite Wastewater Treatment Systems (OWTS).

D- Urban now captured in Category VI- Stormwater Management Program.

M- Estuary Management is under Category VII. It was formerly its own category (XI)

Attachment 3:
Documentation

The following documents may provide the necessary documentation for NPS Pollution Control needs and costs. If you have a document not listed below that you would like to use to document needs or costs, it **must be pre-approved by your EPA region and EPA headquarters** before entering data into the system. Visit www.epa.gov/cwns/ for descriptions of the documents listed below.

Document Type	Can the document be used to justify…	
	Needs?	Costs?
303(d) Listed Water	Yes	No
Approved State 319 Project Implementation Plans	Yes	Yes
Approved State Annual 319 Workplans	Yes	No*
Cost of Previous Comparable Construction	No	Yes
CWSRF Loan Applications	Yes	Yes
Electronic Field Office Technical Guide (eFOTOG)	No*	Yes
Final Engineer's Estimate	Yes	Yes
Intended Use Plan	Yes	Yes
National Estuary Program Comprehensive Conservation and Management Plan	Yes	No*
New Municipal, State or Federal Regulation	Yes	No
Non-governmental Grant Applications	Yes	Yes
Nonpoint Source Management Program/Assessment Report	Yes	No*
Nonpoint Source Management Program/Delegated Underground Injection Control Program Plan	Yes	No*
Nonpoint Source Management Program/Ground Water Protection Strategy Report	Yes	No*
Nonpoint Source Management Program/Wellhead Protection Program and Plan	Yes	No*
NRCS Conservation Plans and Farm Plans	Yes	No*
Nutrient Criteria Studies	Yes	No
Preliminary Engineer's Estimate	Yes	Yes
Professional Appraisals	No	Yes
Sanitary Survey	Yes	No
Section 319 Funded or EPA Reviewed Watershed-Based Plans	Yes	Yes
Source Water Assessment/Source Water Protection Plans	Yes	No
State and Federal Loan and Grant Applications	Yes	Yes
State Needs Surveys & other State forms	Yes	No*
State/Federal Agricultural Cost-Share Program Cost Tables	No	Yes
State-Approved Area-wide or Regional Basin Plan	Yes	Yes
State-Approved Local Comprehensive Water and Sewer Plan	Yes	Yes
Total Maximum Daily Load (TMDL)	Yes	No*
Watershed-Based Plans	Yes	Yes

* With exceptions

Attachment 4:
Mississippi Example

MEMORANDUM

DATE: December 23, 2004

TO: Tom Webb
Mississippi Department of Environmental Quality

FROM: Philip Massirer
FTN Associates, Ltd.

SUBJECT: Documentation of BMP needs for waterbodies impaired by nonpoint sources
Work Order Number: 05-0001FTN/WLBE-037
FTN No. 3120-437

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1. INTRODUCTION

This memorandum documents the methodology and results from our estimation of BMP needs for waterbodies impaired by nonpoint source (NPS) pollution in Mississippi. This methodology was previously applied to selected prototype waterbodies as described in a November 19, 2004 memorandum. Since that time, the methodology has been revised slightly based on review comments from MDEQ and from Tetra Tech (on behalf of EPA). The revised methodology as described below has been applied to all of the waterbodies listed in Sections A, B, and C of the final 2002 Mississippi 303(d) list (dated June 23, 2004). This information is being generated on a statewide basis for MDEQ to enter into EPA's 2004 Clean Watersheds Needs Survey (CWNS) database.

To estimate BMP needs for each waterbody, a spreadsheet with various types of information specific to each waterbody or its watershed was developed and is shown in Attachment A. The organization of the spreadsheet, the data and assumptions used to develop it, and the results of the analysis are described in the following sections of this memorandum.

2. ORGANIZATION OF SPREADSHEET

The spreadsheet in Attachment A is organized with essentially one row for each BMP needed in each 3-digit NRCS watershed. The columns are organized with various types of information and data necessary for estimating BMP needs. Following is a description of the information in each column (or set of columns) and how the information was generated.

Basin, Waterbody ID, and Waterbody name: This information was taken directly from the 303(d) list and TMDL reports.

NRCS watershed number: This is the 3-digit NRCS watershed in which the waterbody is located; it was determined either from the waterbody ID (usually the 3rd through 5th characters)

or from ArcView shape files from MARIS (Mississippi Automated Resource Information System). There are 482 NRCS watersheds in the state.

8-digit HUC: This is the 8-digit Hydrologic Unit in which the 3-digit NRCS watershed is located; it was determined from ArcView shape files from MARIS. There are 53 HUCs within the state.

Pollutant(s) causing the impairment: This was taken directly from the 303(d) list and TMDL reports. If there are multiple pollutants causing a waterbody to be impaired, related pollutants (i.e., pollutants that can be controlled by the same BMPs) are listed on the same line; unrelated pollutants are listed on separate lines.

Pollutant source(s): For waterbodies with TMDL reports, the sources of the pollutants causing the impairment were taken directly from the TMDL report (if they were specified in the report). Otherwise, the pollutant sources were based on information for a similar waterbody with a TMDL report.

TMDL report: This column is marked with "Yes" if a TMDL report for the waterbody has been completed and was available for review by FTN.

Most similar waterbody with TMDL report: For waterbodies without TMDL reports, this column identifies a similar waterbody that does have a TMDL report. For this situation, similar waterbodies are considered to be ones that are nearby (if possible), in the same ecoregion, have similar land uses, and are impaired for the same pollutant or a related pollutant. Various types of information (e.g., sources of pollutants, percentage of NPS load reductions that is necessary to meet water quality standards, etc.) from the TMDL report are assumed to be transferable to the similar waterbody without a TMDL report. Otherwise, for a waterbody without a TMDL report, there would be no way to quantify the NPS load reduction that is necessary to meet water quality standards.

For streams (not lakes) that are impaired by sediment but do not have a TMDL report, this column was used to identify the ecoregion in which the stream is located.

NPS percent reduction needed: This was taken directly from TMDL reports where possible. For waterbodies without TMDL reports and waterbodies with TMDL reports that do not quantify NPS load reductions that are needed, this value was based on information for a similar waterbody with a TMDL report. For streams (not lakes) that are impaired by sediment but do not have a TMDL report, the value for percent reduction needed was set to default values for each ecoregion (72% for Southeastern Plains, 68% for Mississippi Valley Loess Plains, and 17% for Mississippi Alluvial Plain). An explanation of these ecoregion values is presented in Section 4 of this memorandum.

In general, when the column labeled "Pollutant source(s)" is blank, the values in this column represent the necessary percent reduction for the total watershed NPS load. If the column labeled "Source of pollutant" lists a specific source, then the percent reduction in this column represents the necessary reduction for that specific source.

Acreage of each land use: The acreages for selected land use categories within each 3-digit NRCS watershed were generated with ArcView using land use data from MARIS. Land use

acreages have not been generated for drainage areas smaller than the 3-digit NRCS watersheds (even if the 3-digit NRCS watershed is large enough to include multiple impaired waterbodies). For certain situations, the land use acreages were divided by 2 or by 4 to make it easier to avoid applying different BMPs to the same acres in a watershed. Procedures for implementing multiple BMPs within one watershed are discussed later in this memorandum. Land use acreages that are divided by 2 are shown with a "b" after the number and acreages divided by 4 are shown with a "d" after the number.

Percent of total watershed NPS load from each land use: This set of columns was used for situations where a TMDL report specifies NPS reductions as an overall percentage for the whole watershed rather than percentages of loads from individual sources or land uses. These values were used to calculate percent reductions for total watershed NPS loads (see discussion for column labeled "NPS percent reduction achieved").

Within this set of columns, one column is labeled "Other land uses / sources" and was used primarily to identify the percentage of the total watershed load from streambank and channel erosion / degradation for streams impaired by sediment. All occurrences of "70%" in this column represent streambank and channel sources of sediment for streams outside of the Mississippi Alluvial Plain ecoregion (see explanation in Section 4 of this memorandum). In other cases (primarily sediment impairments within the Mississippi Alluvial Plain ecoregion), the values in this column represent loading from land uses or sources other than urban, forest, cropland, and pasture.

When the "Other land uses / sources" column was used for streambank and channel sources of sediment, the percentage of the total watershed load from upland sources was then divided among different land uses (primarily cropland, pasture, and forest) based on relative erosion rates for different land uses from NRCS National Resources Inventory data (see explanation in Section 4 of this memorandum).

Length of impaired waterbody: This information was determined from ArcView shape files from MARIS. These values were used only for implementing stream restoration as a BMP.

Name of BMP: This is the BMP that has been selected to reduce the pollutant causing the impairment in the waterbody. BMPs were selected based on recommendations in a few TMDL reports, personal knowledge about applicability of different BMPs, guidance from personnel in the MDEQ Nonpoint Source group, information in Mississippi BMP manuals for agriculture (MSWCC 2000) and forestry (MFC 2000), and conversations with NRCS personnel about which BMPs are currently being recommended and implemented in different parts of the state.

Effectiveness of BMP: This is the estimated average effectiveness, or percent reduction, for a BMP. For each BMP, the same effectiveness was used throughout the state. For example, every filter strip was assumed to achieve the same percent reduction of sediment and nutrients regardless of location. The cells in this column reference the BMP constants on another page of the spreadsheet; the sources of data and assumptions for the BMP constants are discussed in Section 3 of this memorandum.

Number of units for BMP: This is the number of units of the BMP that need to be implemented. A initial guess at this number is entered and then increased until either the needed percent reduction is achieved or there is no more land in this watershed on which to implement the BMP.

Acres per unit for BMP: This is the number of acres from which NPS pollution is controlled for each BMP unit. For example, it was assumed that slotboard risers are typically placed in ditches with about 50 acres draining into them (on average); therefore, the acres per unit for slotboard risers is 50 (i.e., each slotboard riser structure will reduce the NPS loads coming from 50 acres of land). For BMPs such as no-till, the acres per unit is 1 because each acre of no-till reduces NPS loads from one acre of land. The cells in this column reference the BMP constants on another page of the spreadsheet; the sources of data and assumptions for the BMP constants are discussed in Section 3 of this memorandum.

Acres with BMPs applied: The cells in this column are calculated as the number of units of the BMP multiplied by the acres per unit for the BMP. Each cell in this column contains error checking to make sure that the value of this cell does not exceed a specified fraction of the actual acreage of the appropriate land use (e.g., pasture for fencing, cropland for no-till, etc.) in the 3-digit NRCS watershed. For all BMPs except fencing, pasture improvement, and forest management, the error checking allows BMPs to be applied on 100% of the acreage of the appropriate land use within that 3-digit NRCS watershed. Fencing and pasture improvement were not applied to more than 50% of the pasture acreage, and forest management was not applied to more than 4% of the forest acres. Explanations of these assumptions are presented in Section 5 of this memorandum.

NPS percent reduction achieved: For most situations where percent reductions represent overall watershed values, the cells in this column are calculated using the following equation:

$$\%\ \text{reduction} = \frac{\text{acres of this land use on which BMP is implemented}}{\text{acres of this land use available for BMP implementation in the w'shed}} \times \text{percent of total watershed NPS load from this land use} \times \text{effectiveness of this BMP}$$

For example, if a BMP is implemented on 500 out of 1000 acres of cropland within a watershed, and cropland contributes 40% of the total NPS load for the watershed, and the BMP is 70% effective, then this BMP would reduce the total NPS load for the watershed by 500/1000 × 40% × 70% = 14%.

A second example illustrates use of this equation when multiple BMPs are implemented on the same land use within one watershed. If a watershed has 1000 acres of cropland, and four different BMPs are applied to cropland within that one watershed, then the cropland acreage that is available for implementing each BMP would be 1/4 of the total cropland acreage. In other words, 250 acres would be used in the denominator of the equation above. The percent reduction for the total load from cropland would then be the average of the four percent reduction values for individual BMPs.

For situations where percent reductions are for specific sources (primarily cattle in streams), the cells in this column are calculated using the following equation:

$$\%\ \text{reduction} = \frac{\text{acres of this land use on which BMP is implemented}}{\text{acres of this land use available for BMP implementation in the w'shed}} \times \text{effectiveness of this BMP}$$

For example, assume that a watershed has 1000 acres of pasture, and fencing and pasture improvement are needed to reduce impacts of cattle on bacteria counts in the stream. Because fencing and pasture improvement are both applied to the same land use, the acreage that is available for implementing each of these BMPs would be 500 acres. If fencing is applied to 200 acres of pasture with an effectiveness of 95%, and pasture improvement is applied to 400 acres with an effectiveness of 70%, then the percent reduction for each of these two BMPs would be:

Percent reduction from fencing = (200 / 500) × 95% = 38%
Percent reduction from pasture improvement = (400 / 500) × 70% = 56%

Like a previous example with multiple BMPs on the same land use, the percent reduction for the total load from cattle would be 47% (the average of 38% and 56%).

BMP unit cost: The values in this column represent the cost to implement each BMP unit. The cells in this column reference the BMP constants on another page of the spreadsheet; the sources of data and assumptions for the BMP constants are discussed later in this memo.

BMP total cost: This is calculated as the number of BMP units multiplied by the BMP unit cost.

3. DATA SOURCES AND ASSUMPTIONS FOR BMP CONSTANTS

The BMP constants that were referred to above (BMP effectiveness, BMP units, acres per BMP unit, and BMP unit cost) were developed based on several sources of information as well as various assumptions. Table B.1 (in Attachment B) shows a printout of the BMP constants used in the calculations for each waterbody.

The BMP name and NRCS code identify each BMP in a manner that is consistent with the list of agricultural BMPs in Exhibit A-7 of the CWNS 2004 User Manual as well as the NRCS Mississippi 2004 EQIP (Environmental Quality Incentives Program) Eligible Practice Cost List. The descriptions of the BMPs are self-explanatory and simply provide more information to characterize the BMP. The BMP units and unit cost were taken from the 2004 Mississippi EQIP Cost List, except for stream restoration and forest management (sources for unit costs are documented in Table B.1). Unit costs are statewide average values. Unit costs for certain BMPs were developed by adding costs of individual components as documented in the spreadsheet (e.g., water troughs and pasture improvement). The acres per unit of BMPs represents the acreage from which NPS loads will be reduced by one BMP unit. Assumptions necessary to estimate acres per unit of BMP are documented in the spreadsheet. The BMP effectiveness values are based on research data from Mississippi as well as other parts of the U.S. This research data is summarized in Table B.2 (in Attachment B).

The list of BMPs in Table B.1 obviously does not represent the entire universe of BMPs that can be implemented to reduce NPS pollution, but it does represent BMPs that have published data for effectiveness and have been successfully used or tested in Mississippi. Other agricultural BMPs that are appropriate for Mississippi but are not included in this list are site specific BMPs such as grade stabilization structures (usually to stop erosion from large headcuts) and animal waste management practices (e.g., waste treatment lagoons, composters for dead chickens, etc.). Estimating needed quantities of site specific BMPs such as these would require detailed information and design work that was not possible as part of this statewide analysis. Urban

BMPs were also omitted from this analysis because very few of the impaired waterbodies appeared to be impacted by NPS pollution.

4. PROCEDURES FOR STREAMS IMPAIRED BY SEDIMENT

For streams (not lakes) that were impaired by sediment but did not have a TMDL report that specified a percent reduction, the percent reduction needed was set to the default value for the appropriate ecoregion. Ranges of sediment yield values for stable and unstable streams were developed by the Channel and Watershed Processes Research Unit of the USDA ARS National Sedimentation Laboratory in Oxford, Mississippi based on extensive data collection and analysis (ARS 2002a). Nearly all of the sediment TMDL reports developed for streams in Mississippi refer to this research, but none of the TMDL reports explicitly specify a percent reduction that is needed for the sediment yields. Therefore, MDEQ personnel calculated a percent reduction value for each ecoregion using these sediment yield values and provided this for FTN (see Table C.1 in Attachment C). These resulting values were 72% for the Southeastern Plains, 17% for the Mississippi Alluvial Plain, and 68% for the Mississippi Valley Loess Plains.

Because these percent reductions for sediment were for the overall NPS watershed loads (rather than individual sources of sediment), the distribution of loads among different sources was needed. In other words, if sediment from cropland is reduced by 50%, one still needs to know what portion of the total load is coming from cropland in order to calculate how much the overall NPS watershed load will be reduced. One aspect of the ARS research on sediment yields was evaluation of sediment contributions from streambank and channel erosion / degradation. For the James Creek watershed (located in eastern Mississippi in the Southeastern Plains ecoregion), the ARS estimated that 70% of the sediment was from streambank and channel erosion and 30% was from sheet and rill erosion in upland areas (ARS 2002b). Because the ARS did not quantify the portion of the total sediment yield that was due to streambank and channel erosion for other streams or ecoregions in Mississippi, the 70% / 30% distribution was used in this spreadsheet for all streams impaired by sediment throughout the Southeastern Plains and Mississippi Valley Loess Plains ecoregions. Because the Mississippi Alluvial Plain ecoregion has significantly different topography and soils than the other ecoregions, no specific distribution of channel erosion versus upland erosion was assumed for the Mississippi Alluvial Plain ecoregion.

The sediment from upland sources was then divided between different land uses. For the Mississippi Alluvial Plain ecoregion, upland sources of sediment were divided between urban, forest, cropland, pasture, and “other land uses / sources” based on loads from each land use in TMDL reports for Bee Lake, Moon Lake, Wolf Lake, and Lake Washington. Because each of these four TMDLs indicated a fairly similar distribution of loads among different land uses, the percentages from these four TMDLs were averaged. The resulting average distribution of sediment (83.7% from cropland, 11.3% from pasture, 0.3% from urban, 2.3% from forest, and 2.4% from other land uses and sources) was used for the distribution of upland sources of sediment throughout the Mississippi Alluvial Plain ecoregion. These values were entered in the columns labeled “Percent of total watershed NPS load from each land use”. Calculations to develop these values are shown in Table C.2 (in Attachment C).

For streams in the Southeastern Plains and Mississippi Valley Loess Plains ecoregions, the sediment from upland sources was divided between forest, cropland, and pasture based on average erosion rates for different land uses in Mississippi. Erosion rates for different types of cropland and pasture were taken from a summary of the 1997 NRCS National Resources

Inventory (NRI) data and averaged using their statewide acreages as a weighting factor (see Table C.3 in Attachment C). The forest erosion rate was based on information from Grace (2000), Grace (2002), Williams et al (1999), and Fulton and West (2002) (see bibliographic citations in Attachment C). These average rates of annual erosion per acre for cropland (5.4 tons/ac/yr), pasture (1.2 tons/ac/yr), and forest (0.2 tons/ac/yr) were multiplied by the corresponding acreages of these land uses in each watershed to estimate relative contributions of sediment from these three land uses. Following are example calculations for distribution of sediment from a hypothetical watershed in the Southeastern Plains or Mississippi Valley Loess Plains ecoregion with 100 acres of cropland, 200 acres of pasture, and 300 acres of forest:

% of total watershed sediment load from streambank and channel erosion = 70%

$$\text{\% of total watershed sediment load from cropland} = \frac{5.4 \times 100}{(5.4 \times 100) + (1.2 \times 200) + (0.2 \times 300)} \times 30\% = 19\%$$

$$\text{\% of total watershed sediment load from pasture} = \frac{1.2 \times 200}{(5.4 \times 100) + (1.2 \times 200) + (0.2 \times 300)} \times 30\% = 9\%$$

$$\text{\% of total watershed sediment load from forest} = \frac{0.2 \times 300}{(5.4 \times 100) + (1.2 \times 200) + (0.2 \times 300)} \times 30\% = 2\%$$

The resulting values (70%, 19%, 9%, and 2% for this example) would be shown in the spreadsheet in the columns labeled “Percent of total watershed NPS load from each land use”.

After the sediment loads were distributed between streambank / channel erosion and each individual land use, BMPs were applied to achieve the needed percent reductions. For streams impaired by sediment in the Mississippi Alluvial Plain ecoregion, no specific distribution of channel erosion versus upland erosion was assumed (as mentioned previously). Therefore, a 17% reduction (the ecoregion default value) was sought for both upland erosion and streambank / channel erosion for those streams. In other words, upland BMPs (e.g., no-till, filter strips, riparian buffer strips, and slotboard risers) were used to achieve a 17% reduction of upland erosion and stream restoration was applied to achieve a 17% reduction of streambank / channel erosion.

For streams in the Southeastern Plains and Mississippi Valley Loess Plains ecoregions, BMPs were applied to achieve an overall reduction of either 72% (Southeastern Plains) or 68% (Mississippi Valley Loess Plains). In many cases, this allowed some flexibility of whether to choose more stream restoration and fewer upland BMPs, or less stream restoration and more upland BMPs. Although the stream restoration costs for most watersheds were quite high, stream restoration was necessary to address the large portion (70%) of the sediment load that is being contributed by streambank / channel erosion. In some watersheds (depending on the length of the impaired stream), streambank erosion provided a larger percent reduction of the total watershed sediment load per dollar of cost than did pasture improvement. In those watersheds, pasture improvement was minimized. In other watersheds where streambank restoration was more expensive per unit of reduction, streambank restoration was minimized.

5. OTHER ASSUMPTIONS AND PROCEDURES

For lakes impaired by sediment in the Mississippi Alluvial Plain ecoregion, the percent reduction needed was based on TMDL reports for Bee Lake, Dump Lake, Moon Lake, and Wolf Lake. The required percent reductions for sediment and BOD are summarized in Table C.4 (in Attachment C). Based on these values, a value of 45% was used for the percent reduction needed for all lakes impaired by sediment in the Mississippi Alluvial Plain ecoregion. The one exception to this was Lake Washington, where the percent reduction needed was set to 50% based on a TMDL for that waterbody. There were no lakes impaired for sediment outside of the Mississippi Alluvial Plain ecoregion.

Several assumptions were necessary for implementing forest management. First, forest management was defined as combinations of site specific practices related to reducing sediment and nutrient yields from forested areas with being harvested. Therefore, forest management is not needed for areas without harvesting activity. The average percent of forest land that has harvesting activity in any particular year was estimated to be 4% based on information from Mississippi Forestry Commission personnel (MFC 2004). Therefore, implementation of forest management was limited of 4% of the forest acreage in any particular watershed. Since forest management was only being implemented on a small fraction of the total forested area, it was necessary to estimate how much of the total sediment load from forest was coming from areas with harvesting activity. Based on published information from several research projects, it was assumed that forest areas with harvesting activity contribute 23 times as much sediment per acre as undisturbed forest areas. Combining this ratio (23) with the percent of land with harvesting activity (4%), it was calculated that about 50% of the total sediment load from forest would come from land with harvesting activity and the other 50% would come from undisturbed forest. Calculations for these values are shown in Table C.5 (in Attachment C).

These assumptions and calculated values for forest management were incorporated into the equation for calculating percent reduction achieved. For example, assume that a watershed has 1000 acres of forest, all of the forest land combined contributes 20% of the total watershed load of sediment, forest management is implemented on 40 acres, and forest management is 80% effective. The resulting percent reduction of the total watershed load of sediment would be:

$$\text{\% reduction of total watershed sediment load} = \frac{\text{40 acres}}{\text{1000 acres} \times 4\%} \times \text{20\% of total watershed load from forest} \times \text{50\% of forest load from area with harvesting} \times \text{80\% effective} = 8\%$$

This example shows that the forest management typically provides a relatively small reduction in the total watershed sediment load. However, forest management was used in the spreadsheet for many watersheds because it could sometimes provide reduction of sediment loads in a more cost effective manner than some other BMPs.

For pasture land, the BMPs that were implemented were fencing, water troughs, and pasture improvement. Based on experience of MDEQ Nonpoint Source personnel and comments from Tetra Tech on the November 19 submittal (documentation of BMPs for prototype waterbodies), neither fencing nor pasture improvement was allowed to be applied to more than 50% of the pasture acreage in a watershed. Essentially, it was assumed that about half of the pasture acreage already has some fencing to keep cattle out of streams and that about half of the pasture acreage

already has a good stand of grass and does not need pasture improvement. Water troughs were applied only where fencing was applied.

One other assumption that was used in this analysis was that streams on the 303(d) list for biological impairment could be treated as if they were impaired by sediment. This assumption was based on best professional judgement from MDEQ personnel and was supported by a brief review conducted by FTN showing similar land use between streams on the 303(d) list for sediment and nearby streams on the 303(d) list for biological impairment.

6. RESULTS

For each impaired waterbody, the number of BMP units needed and the cost to implement them was estimated in Attachment A. Because Attachment A consists of approximately 2400 lines of data, the numbers of BMP units and their costs were summarized by 8-digit HUC as shown in Attachment D. This summary of the data will be entered into EPA's CWNS database by MDEQ.

The grand total cost for implementing BMPs to address nonpoint source impairments throughout Mississippi was almost $1.5 billion. A large portion of that cost (almost $1.2 billion) was for stream restoration, which was caused by three factors. First, streambank and channel erosion was assumed to be the source of a large portion (70%) of the total sediment load in streams impaired for sediment throughout the Southeastern Plains and Mississippi Valley Loess Plains ecoregions. Second, there are a large number of streams on the 303(d) list for sediment or for biological impairment (which was treated like a sediment impairment as discussed previously). Third, stream restoration has a rather expensive unit cost ($60 per foot of stream length).

The large quantity and cost of BMPs that was estimated from this analysis is partly a result of large NPS reductions that TMDL reports and sediment loading studies have estimated to be necessary in order for impaired streams and lakes to meet standards. For example, the sediment loading studies by ARS showed sediment yield values that correspond to 68% and 72% reductions two ecoregions, and several bacteria TMDL reports (e.g., Bayou Pierre) specify an 80% reduction of septic system loads and an 85% reduction of loads from cattle in streams. When the percent reduction needed is large and is a similar magnitude as the effectiveness of the BMPs being implemented, then BMPs have to be implemented on every acre of land or on every mile of stream in order to achieve the percent reduction desired.

7. OTHER MISCELLANEOUS INFORMATION

The pollutant reductions from existing BMPs were accounted for implicitly in this methodology because the required pollutant reductions were derived from TMDLs that were generally developed using recent water quality data (i.e., data collected with some BMPs already in place). It is assumed that implementation of additional BMPs since these TMDLs were developed is minor because the TMDLs were all developed recently (i.e., between 1999 and 2004).

The methodology described in this memo is designed to estimate needs to address only nonpoint source impairments (Category VII in the CWNS database) and does not address point source issues. Although septic systems create nonpoint source pollution, costs for reducing pollution from septic systems were set to zero in this spreadsheet because those costs were assumed to be included in a different CWNS category.

Also, this methodology was developed for estimating BMP needs on a large scale (i.e., statewide) basis. Therefore, the estimated BMP needs for any given waterbody may be too high or too low (but should average out on a large scale basis). Prior to implementation, BMPs should be planned and designed in greater detail on a much smaller scale.

8. REFERENCES

(Note: Additional references are cited in the Attachments to this memorandum.)

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